

GEORGE MATTHIESSON . 1969

ECOLOGY IN DORCHESTER BAY

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In February, 1969, the Harbor Islands Study Group of the

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Massachusetts Institute of Technology published a report entitled The Harbor Islands, in which certain possible plans for developing fuller use of the Islands were presented. The most intensive development plan would involve linkage of the Thompson, Spectacle, Long and Moonhead Island complex to the mainland at Squantum, by means of structural causeways; in addition, certain of the shoal water areas on the southeast side of Thompson's Island and south of Moonhead would be filled to form additional land masses. Obviously such a plan, if implemented, would have certain ecological effects that might conceivably extend beyond the immediate vicinity of the Islands mentioned.

The purpose of this Report is to summarize certain data relative to the ecology of the Harbor and its marine resources and to suggest certain policies regarding their future use. Although it is impossible to predict precisely the ecological consequences of the proposed plan, it is at least possible to propose certain basic guidelines and to indicate opportunities for fuller use of the Harbor environment that would not have negative effects upon its resources.

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1. The Harbor environment

Data on the Harbor environment have been gathered by the Federal Water Pollution Control Administration (Ref. 1). Certain characteristics of the Harbor are as follows:

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- 1) The Harbor is more oceanic than estuarine. Even at low tide, the salinity throughout much of the Harbor is in excess of 30 o/oo, indicating that freshwater inflow from the various tributaries - the Neponset, Childs, Mystic, Fore, Back and Weir Rivers - is rather small in comparison with the tidal prism volume, i.e., the total volume of water entering the Harbor from the sea on a flooding tide. The maximum flow from these tributaries has been estimated at 1,800 cubic feet per second, as compared with 320,000 cfs average during a flooding tide.
- 2) On a volume-flow relationship, the Harbor water is exchanged within a twenty-four hour period, or during two complete tidal cycles. Although this in fact does not occur for all of the Harbor, and the residence time in certain areas is evidently greater than this, the mean nine-and-a-half foot tidal amplitude and the strong tidal currents - up to 2 knots in the main channels - indicate that a high rate of tidal flushing is characteristic of much of the Harbor.
- 3) The Harbor is heavily enriched with organic matter from sewage disposal facilities at Deer, Nut and Moon Island, and by raw sewage from numerous other sources. As a result, high nutrient concentrations - particularly nitrate and phosphate - exist, with resultant dense populations of benthic macroscopic algae and phytoplankton. Although such enrichment, or eutrophication, initially helps support

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populations of species that are economically or recreationally desirable, such as the soft shell clam (Mya arenaria) or winter flounder (Pseudopleuronectes americanus), negative results are evident in certain areas of the Harbor, i. e., accumulation and decay of algae, offensive odors derived from hydrogen sulfide formation, unattractive water coloration, etc. Without active tidal exchange, these conditions would accelerate rapidly.

- 4) FWPCA data (Ref. 1) indicate that the concentration of dissolved oxygen in the Harbor waters is renewed by tidal exchange, that the warmer tributary waters are relatively low in oxygen, and that reductions in oxygen occur in areas where flushing is poor. For much of the Harbor, oxygen concentrations meet conventional standards for water quality at the present time.
- 5) On the basis of sampling for benthic organisms, the Harbor bottom and environment is biologically "degraded". In many areas, the bottom sediment is characterized by black ooze, the offensive odor of hydrogen sulfide, and low species diversity and, in some instances, numbers. The following summary (Ref. 1) is significant:

"In various areas bottom sediments were found to be in an advanced state of decomposition. The large influx of pollutants into the harbor in conjunction with the poor flush rates and low tidal currents prevalent in most of the area allow the deposition of organic matter on the bottom, thus degrading the environment and making it unsuitable for most forms of marine life. In areas of higher tidal velocities where deposition is held to a minimum , environmental conditions remain the same" (as found during the 1967 survey).

Although there is some evidence that, in certain areas of the Harbor such as Dorchester Bay, deterioration of the environment has increased, much of the Harbor nevertheless continues to support appreciable populations of marine organisms, many of which are desirable from both economic and recreational points of view. The fact that this is so can be attributed to effective tidal exchange, which, so far, has prevented conditions associated with advanced eutrophication: prevalent algal decay, oxygen depletion, fish mortalities, etc. Conversely, any factor or combination of factors that might reduce or impede tidal exchange in areas of the Harbor would in all likelihood have severe ecological consequences, with rapid deterioration of the environment.

The following description of San Francisco Bay (Ref. 2) is relevant to Boston Harbor:

"In comparison with waterways in other parts of the country and of the world, the waters of the Bay and Delta are relatively "clean". However, conditions existing in some parts of the area attest to the facts that the balance between "clean" water and polluted water may be a delicate one and that conditions do exist which, if not corrected, could lead to serious degradation of water quality. . . . In the southernmost part of the Bay waste discharges cause low levels of dissolved oxygen. Such conditions have resulted in adverse biological effects, odors and nuisances. Diversity of species of marine organisms, an indication of ecological well-being, is also much lower in the southern extremity of the Bay than in other portions, and a high level of biostimulants causes extensive algal growth in the Alviso Slough area. . . . In portions of the Bay, fish kills have occurred over the years and, although in many cases their causes have not been identified specifically, it is probable that discharges of toxic material to the waters and low diluting flows are responsible. Bacteriological standards of the state for water contact sports and shellfishing are not met in most portions of the bay, and studies by the State and county departments of public health have resulted in the prohibition

of swimming and other water contact sports and/or of shellfishing for human consumption along much of the shoreline".

Excessive eutrophication has occurred in many bodies of water throughout the country, with disastrous consequences (Ref. 3). It could happen, and perhaps is happening, in Boston Harbor.

2. The marine resources of Dorchester Bay

During 1967 and 1968, the Massachusetts Division of Marine Fisheries undertook a survey of the marine resources of Dorchester Bay. (In addition to Dorchester Bay proper, this area includes the Neponset River, Squantum Bay, and the body of water bordered by Thompson's Island and Spectacle Island to the northwest, and Long Island and Moon Head to the southeast). A total of twenty-one species of finfish were sampled in this area, including certain recreationally and commercially important species as winter flounder, smelt and striped bass. Although cod were not sampled during this survey, this species is known to provide excellent sportfishing in this area during certain seasons of the year.

Dorchester Bay supports extensive populations of soft shell clams. Preliminary analysis of the data indicates a potential yield of roughly 50,000 bushels of marketable clams, or approximately the same amount as that estimated for Quincy Bay (Ref. 4). Shellfishing in the Dorchester Bay area, however, is severely limited as a result of pollution, and there is no unrestricted digging in the area. The major portion of the flats are closed to any form of shellfishing.

In 1967, forty-one commercial lobstermen set pots in the Dorchester Bay area. The majority of these fished in the vicinity of Long Island, rather than near the mouth of the Neponset River where circulation is poor, the salinity reduced, and evidence of environmental degradation apparent. This fishery is active for only a small part of the year, i.e., during the summer months.

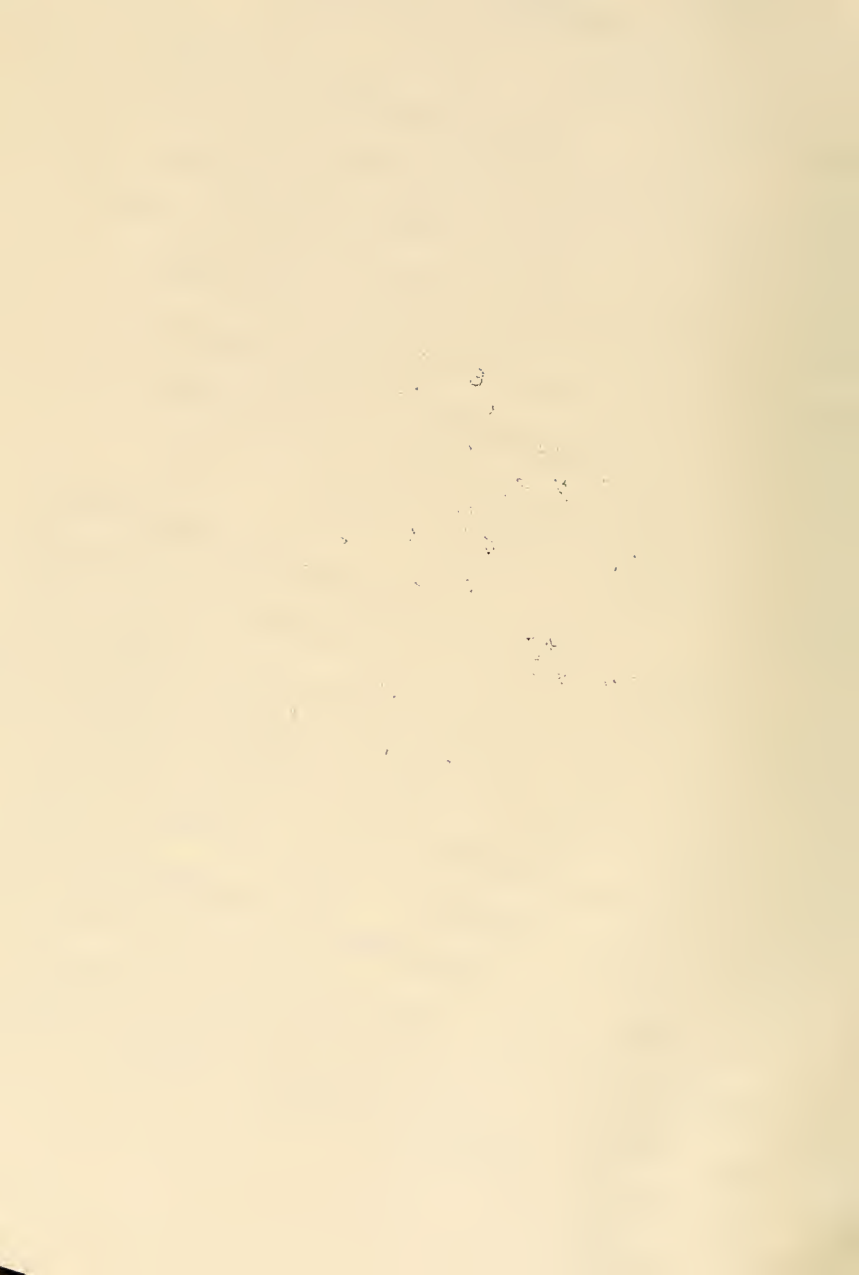
As a result of pollution, the commercial significance of the marine resources of Dorchester Bay is limited. However, the social, and possibly economic, benefits to be derived from recreational fishing in this area should be considered in future planning. Boston Harbor and the waters of Dorchester Bay, despite high levels of pollution, support populations of important fish species during all months of the year. Winter flounder are available to the angler from April to October; striped bass, from May to October; cod, from November to April; mackerel, from July to September; and smelt, from September to January. During the appropriate seasons, fishing for each of these species may be excellent, which, in view of the pollution in the Harbor and its highly developed and industrialized shoreline, provides unique recreational opportunities.

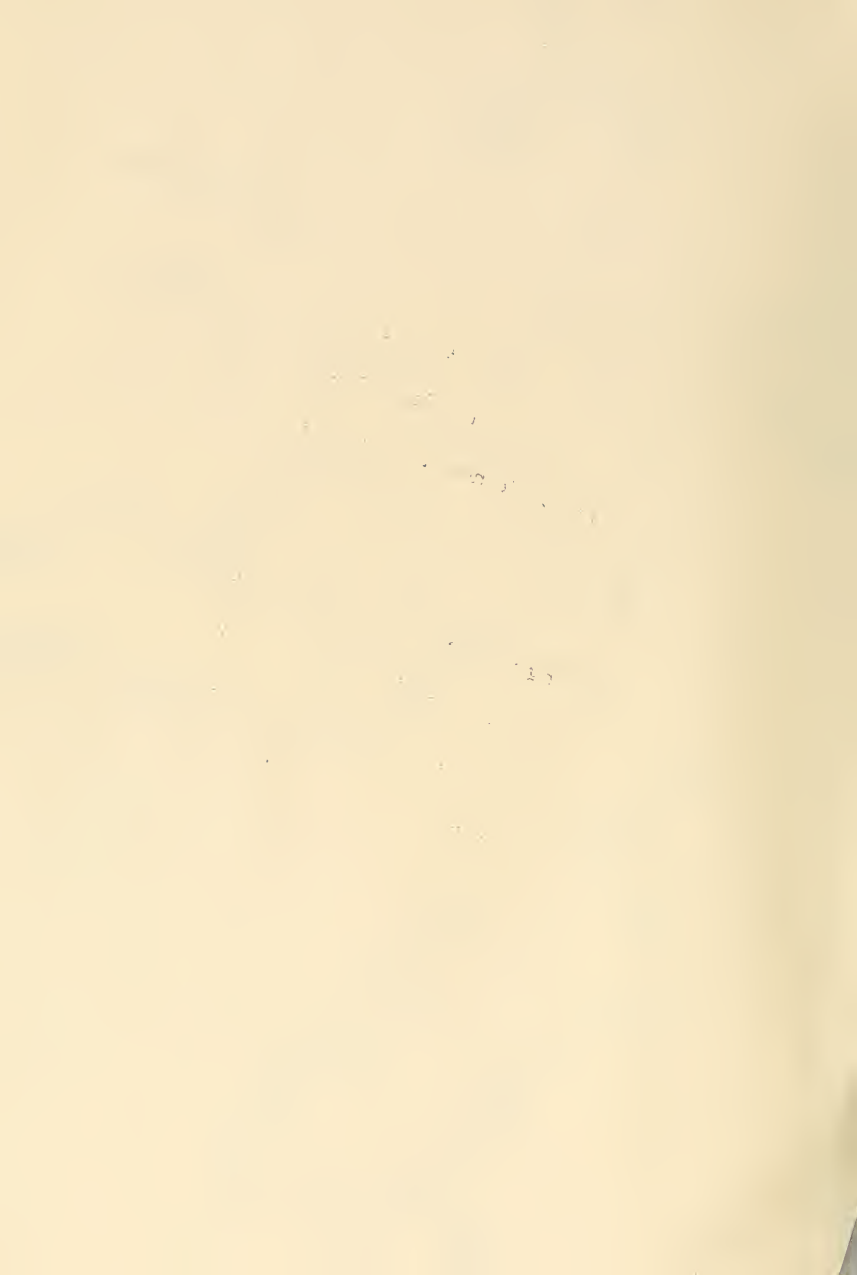
From both a recreational and commercial viewpoint, the most important single species frequenting the Harbor is the winter flounder. While ranking number one among Massachusetts sportfishermen in popularity, this species is also fished intensively by commercial fishermen along the entire coastline and offshore. During certain phases of its life cycle

(Ref. 5), shoal, inshore areas such as Boston Harbor and its tributaries play a critical role, and it has been calculated that this fishery could be eliminated by excessive coastal alteration.

Since 1961, investigations on the winter flounder population in Boston Harbor have been undertaken by the Massachusetts Division of Marine Fisheries. It is evident that the Harbor provides a highly favorable spawning and nursery area for this species and that, as indicated in Fig. 1, flounder originating in the Harbor may contribute to fisheries not only in adjacent waters but also considerable distances offshore. The fish appear to spend their first three-to-four years within the Harbor, tending to wander out of the Harbor and farther offshore as they grow larger.

It is possible that the Neponset River plays an extremely important role in the ecology of this species, both as a nursery area for juvenile fish in their first year, and as a spawning ground for adults. Sampling by the Division of Marine Fisheries in the Neponset River-Dorchester Bay system indicated that the flounder population varied in size from 35 mm (1.5 inches) to 380 mm (15 inches) in length, with a high percentage in the 50-100 mm (2-4 inch) range. The greatest percentage of small fish were found in the vicinity of Granite Avenue. Since the Neponset is one of the few estuarine areas in the Harbor - salinities at Granite Avenue were found to average 12.2 o/oo - it is possible that this particular environment may be of particular significance.





The fact that this species can adjust to, and in fact thrive in, conditions such as the Neponset not only attests to its hardiness but also indicates that the River still satisfies its requirements for food, oxygen and suitable substratum. It is difficult to envision how these requirements could be satisfied if River flow or tidal exchange at the mouth were impeded, as might result from landfill causeways from Squantum to Thompson's Island, or by any form of obstruction between Columbia Point and Thompson's Island. As mentioned earlier, there is some evidence of increasing environmental degradation in Dorchester Bay, and it is possible that further degradation could impose conditions that this species could no longer tolerate.

Proposed Harbor Modifications

Any plan involving physical alteration of the Harbor environment should consider not only the possible negative ecological consequences upon the resources but also possible modifications or improvements that might lead to broader use of these resources. The importance of maintaining adequate circulation in areas such as Dorchester Bay has already been stressed. Filling of the shoal area along the southeast shore of Thompson's Island would involve a direct loss to a portion of the clam population in the Dorchester Bay area, as would filling south of the causeway between Moon Head and Squantum. As long as adequate circulation between the Long, Moon, Spectacle, Thompson's and Squantum complex was maintained, however, such negative consequences should be confined to these particular flats. (It should

be noted, however, that the gradual extension of the sand bar from Thompson's Island towards Squantum was apparently the result of the construction of the Moon Island causeway. If the southeast shoreline of Thompson's Island is filled, then precautions should be taken to insure that the channel between Thompson's Island and Squantum is maintained).

If the Islands are linked by structural causeways, whereby tidal flow is not obstructed, the recreational potential for the area would be enormous. Assuming adequate access, and in addition to the obvious benefits of hiking, bird-watching, etc., the opportunities for inexpensive, year-round recreational fishing would be unique. This would be particularly so if fishing platforms were made an integral part of the causeways, and if sections of the causeways could be used as docks for skiffs and boat liveries. The existing, but partially destroyed, piers on Thompson's and Long Island might be improved and developed into fishing piers extending into the deeper waters of the Harbor only yards offshore.

Since 1957, the Wildlife Conservation Board of the State of California has been active in construction of fishing piers in cooperation with interested towns. Not only has the public made extensive use of these piers, but there have been other indirect social benefits as well, including a reported decline in juvenile delinquency in areas of pier construction. (Details on the history of fish pier construction in California are appended to this report, including statistics on cost, use, and details of construction.) These piers have

helped satisfy social needs for recreation, sightseeing, and simply an association with the marine environment that is otherwise unavailable to a large percentage of the urban population.

As indicated in Ref. 6, new fishing piers are not inexpensive. In 1965, newly constructed piers had an estimated cost of ten to thirty dollars per square foot. On the other hand, a converted pier in Santa Cruz, with a total length of only 230 feet, has an estimated yearly use of 200,000 people, and cost of construction was approximately fifty thousand dollars. Should a salt water fishing license ever become a reality in Massachusetts, it would seem that there could be no more tangible and obviously beneficial use of license fees than in the construction of fishing piers in areas such as Boston Harbor, or in the acquisition of public access points along the Harbor shoreline. (At the present time, there are only 25 boat launching ramps, 8 boat liveryes, and 4 piers available for public fishing in the entire Harbor.)

Summary

The difficulty in predicting precisely the consequences of establishing a new Harbor community, in terms of its effects upon the Harbor's marine resources, derives from incomplete knowledge of the Harbor's ecology. It seems obvious that maintenance, and possibly the improvement, of tidal exchange in areas of the Harbor would be vital to the Harbor's ecological well-being. It is not clear, however, as to what precise and long-range effects the proposed land-fill projects might have on the

circulation pattern in the Dorchester Bay area. There are indications that the Harbor environment, at least in certain areas, is deteriorating. In the absence of pollution abatement, it is uncertain what the rate of deterioration may be, and how it may effect the proposed community.

Various aspects of the Harbor environment have been studied, or are under study, by different groups and agencies, including the Massachusetts Division of Marine Fisheries, Massachusetts Division of Water Pollution, Massachusetts Department of Public Health, Federal Water Pollution Control Administration, and others. Students from certain colleges and universities in the area have initiated research projects in the Harbor. These investigations do not seem to have been coordinated, resulting in a certain degree of duplication of effort.

It would seem highly worthwhile if these research efforts were integrated, and the talents and energies of students drawn upon, for field work in particular. Representatives of the various groups might meet on a periodic basis to discuss research problems and needs relating to the Harbor. Personnel of the State and Federal agencies might assist in guiding students working on Harbor projects, since they represent a potential and much-needed source of man-power.

Certainly one of the immediate functions of such a group would be to decide a) where additional research is most needed, b) how the research should be conducted, and c) who should be responsible for various elements of the research.

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